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AUTHOR Tamaoka, Katsuo
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ABSTRACT

The historical development of learning style inventories is examined from the dichotomous concepts of cognitive styles to multidimensional assessment. Based on a series of experiments on vertical perception, H. A. Witkin formed the concepts of field-dependent and field-independent cognitive styles. Using the term "learning styles" instead of cognitive styles, D. A. Kolb developed a more applicable theoretical model of a four-stage learning process. Although Kolb's model successfully provided group characteristics in learning styles based on students' subject majors, his inventory remained as an overall indication of learning styles. To provide more specific data, A. A. Canfield designed multidimensional inventories to assess both students' learning styles and teachers' instructional styles. Since Canfield's model included various aspects of human learning, his inventory provided further individualized information that can be used for instructional counseling. Some variations influencing learning styles are still excluded from the inventory, such as individual abilities, motivation, and cultural and linguistic backgrounds. A list of 35 references is included. (SLD)

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Historical Development of Learning Style Inventories from Dichotomous Cognitive Concepts of Field Dependence and Field Independence to Multi-Dimensional Assessment

Katsuo Tamaoka

Matsuyama University, Matsuyama, Japan

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Requests for reprints should be sent to Katsuo Tamaoka, College of Business Administration, Matsuyama University, 4-2 Bunkyo-cho, Matsuyama #790, Japan.

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Abstract The present study examined the historical development of learning style inventories from the dichotomous concepts of cognitive styles to multi-dimensional assessment. Based on a series of experiments on vertical perception, Witkin formed the concepts of field-dependent and field-independent cognitive styles. It was, however, not enough to identify detailed individual cognitive styles by a dichotomous categorical approach. Using the term 'learning styles' instead of 'cognitive styles', Kolb devel oped a more applicable psychological theoretical model of a four-stage learning process. Although Kolb's model successfully provided group characteristics in learning styles based on students' subject majors, his inventory remained as an overall indication of learning styles. In order to provide more specific data on learning styles, Canfield designed multi-dimensional inventories to assess both students' learning styles and teachers' instructional styles. Since Canfield's model included various aspects of human learning activities, his inventory of learning styles provided further individualized information which can be used for instructional counselling. However, there are still some variations excluded in the inventory influencing learning styles, such as individual abilities, motivation and cultural/linguistic backgrounds.

1 Introduction

Studies of learning style originated as studies of cognitive style. In an early stage, Witkin (Witkin & Asch 1948a, 1948b, 1948c ; Witkin, 1949, 1950a, 1952) conducted a series of experiments on vertical perception which led him to form the concepts of field-dependent and field-independent

cognitive styles. Kolb (1971, 1974) devised an inventory containing four categories of learning styles. This inventory successfully assessed a group of students' overall learning preferences based on the students' subject majors. In the late 1970s, Canfield (Canfield & Canfield 1976 : Canfield 1980) designed multi-dimensional instruments which can be utilized to provide more detailed information on learning and instructional styles.

The following sections review and assess the work of Witkin, Kolb and Canfield.

2 Witkin's Experiments on Vertical Perception

Researching cognitive styles, Witkin began with a series of experiments which were concerned with how people locate the upright in space. From 1948 to 1952, he developed three kinds of orientation tests, namely body-adjustment test, the rod-and-frame test and the rotating-room test. The initial concepts of field-dependent and field-independent cognitive styles were derived from these experiments.

2.1 The Body-Adjustment Test

The aim of the body-adjustment test was to determine how the upright was estabIlished in the absence of a surrounding visual field. To eliminate the visual field, the subject was located in a completely darkened room. The visual datum was a luminous rod. The subject had to adjust the rod to the true vertical and horizontal. The positions of the subject's head and body were varied systematically to compare the accuracy of judgement in each position (Witkin & Asch, 1948a, 1948b, 1948c ; Witkin 1949).

From the third experiment of this test, it was found that the "errors vary in magnitude with the amount of body tilt, the largest error occurring

when the body is in a horizontal position" (Witkin & Asch, 1948c, p. 610). It was clear that when the body was upright, postural factors were adequate for judging the vertical and horizontal, but when the body was tilted, postural factors provided a less effective basis for judgement. In addition, some subjects seemingly did much more poorly than others (Witkin & Asch, 1948c). This result indicated that individual factors affected the magnitude of errors.

Witkin considered intellectual factors not to be an issue. As a college population was used for subjects, they had considerably more intellectual capacity than was required for the tasks in the experiment (Witkin, 1949). Thus, the possibility of another factor remained in this study. Under six different conditions, 45 subjects of 274 became ill, so that some errors may have been caused by "the suppression of certain experiences under conditions of sensory conflict" (Witkin, 1949, p. 45).

2.2 The Rod-And-Frame Test

Following the body-adjustment test, Witkin devised the more detailed test called the rod-and-frame test. The aim of experiments with the rod-frame test was to examine how visual frameworks of different tilts and different body positions affected perception of the upright. In this test, the visual field consisted of a simple luminous frame which was contained in a completely darkened room. A luminous rod was located within the frame. The subject had to set the rod to the vertical and horizontal. The frame was tilted 28 degrees right, 28 degrees left, or erect. At the same time, the body was also erect or tilted 28 degrees left. In this experiment, 53 adults were used as subjects (Witkin & Asch, 1948d).

When the body was tilted 28 degrees left and the frame was tilted 28

degrees right, the figure of distributions clearly showed individual differences in perceiving the upright (Witkin & Asch, 1948d). In his discussion of findings of theses studies, Witkin made the following important observation :

> There were subjects who, despite the tilt of the frame, brought the rod close to the true vertical and horizontal : at the other extreme subjects perceived the tilted frame as upright, and aligned the rod with it (Witkin & Asch, 1948d, p. 781).

To generalize this result, some people were strongly affected by the surrounding field while others were able to escape this influence and locate the upright independently. However, the distributions of scores in this experiment did not reveal two distinguishably different groups. What was found was a variety of individual responses rather than two distinct ways of perceiving the upright.

2.3 The Rotating-Room Test

The aim of the rotating-room test was to determine how a basic change in postural factors affects perception of the upright. To accomplish such a change in postural factors, the subject was seated in a completely enclosed room, and rotated about a circular path. Under this condition, the force acting upon the subject's body was changed from the true upright. The task of the subject was to adjust a rod on the front wall of the room to the true vertical and horizontal during rotation conducted at two speeds. A total of 258 subjects participated in the various experiments (Witkin, 1950a).

The results of the experiments were reported according to the presence or absence of an upright visual field at a lower or higher speed. In the

presence of the upright visual field at the lower speed, (the force on the body shifted by 20.5 degrees), the mean error in adjusting the rod to the vertical and horizontal was 3.1 degrees. At the higher speed (the force on the body shifted by 33.4 degrees) the mean error was 6.3 degrees. In the absence of the upright visual field, the mean error rose to 10.7 degrees at the lower speed and 24.7 degrees at the higher speed. In this set of studies, Witkin found marked individual differences of perception in establishing the upright during rotation (Witkin, 1950a).

Furthermore, Witkin indicated two distinguishable groups. Subjects who tilted their bodies far toward the tilted room in the body-adjustment test were also likely to tilt the rod far toward the tilted frame in the rod-and-frame test and to align their bodies with the upright room in the rotating-room test. In contrast, the subjects in the other group brought their bodies close to the true upright in the body adjustment test, regardless of room position. They were also likely to separate the rod from the frame in the rod-and-frame test and adjust the rod close to the upright. In addition, they were also likely to tilt their bodies toward alignment despite the centrifugal force acting upon them (Witkin & Goodenough, 1981).

2.4 Summary

From reviewing the three kinds of orientation tests used by Witkin, it is possible to summarize the results of the experiments into four points:

(1) *There were individual differences among subjects.* Throughout three kinds of orientation tests, Witkin found that subjects were markedly different from one another in their performance. This may indicate that each individual has his own preferred way of integrating information for locating the upright.

(2) *There were self-consistencies among subjects.* The results of Witkin's three orientation tests indicated that each individual tended to use the same way of integrating information for locating the upright under various conditions.

(3) *There seemed to be two distinguishable groups among subjects.* Although it was not clearly shown in the two extreme distributions of scores in Witkin's three orientation tests, subjects could be separated into two different groups.

(4) *The results of the experiments might not be related to the intelligence of the subjects.* Adults who were considered to be able to manipulate tasks were used as subjects in Witkin's three orientation tests. Because of the very simple tasks executed in the experiments, errors made by subjects would not be caused by their lack of intelligence. This indicated that the way of integrating information for locating the upright had no relation to intelligence.

3 Witkin's Dichotomous Concepts of Cognitive Styles

Generalizations from the experimental results of the three orientation tests were limited to the perception of the upright. To continue his experiments, Witkin carried out a new kind of test called the embedded figures test. Based on the results of this test, he mapped out definitions of two tendencies: field dependence and field independence. Later on, these definitions were developed into the general concepts of field-dependent and field-independent cognitive styles. Retracing these steps will clarify the explicit definitions of field dependence and field independence as one aspect of human congnitive styles.

3.1 The Embedded Figures Test

The purpose of the embedded figures test was to demonstrate how contextual factors affect perception. The test used by Witkin was originally devised by Gottschaldt (1920). Subjects in this test were required to find simple figures within complex ones. Witkin chose eight of Gottschaldt's original simple figures and 24 complex figures. To develop an additional means of obscuring the simple figures, Witkin colored the complex figure so as to reinforce a given pattern and its subpatterns. Test data treated both the distributions of time scores for men and women and the solution time for individual complex figures (Witkin, 1950b).

In the test, the average performance of women was significantly poorer than that of men. There were 88 instances of failure for women, compared with 35 for men in the entire series. Witkin considered that women possess "stronger adherence to the structure of the presented field" (1950b, p. 13). Along with this, Witkin also found remarkable individual differences. Furthermore, Witkin reported that the subjects tended to be self-consistent in performance (1950b). This observation may suggest that individual differences are caused by personal factors in each subject.

As with the results of the three orientation tests, the embedded figures test showed subjects who did well and subjects who did poorly (Witkin, 1950b). Witkin offered the same explanation as used for the previous tests ; subjects who performed poorly had a tendency to adhere to the pattern of the complex figure while subjects who performed comparatively well escaped this influence.

Witkin's results for the embedded figures test were similar to those of the three orientation tests ; remarkable individual differences, self-consistencies and two distinguishable groups among subjects. However, the

relatively high correlation between the embedded figures test and the intelligence test (Witkin, 1950b) showed that the intellectual capacity of the subject might influence the results of the embedded figures test.

3.2 Definition of the Dichotomous Concepts

From the findings of the body-adjustment test, the rod-and-frame test, the rotating-room test and the embedded figures test, it may be concluded that each individual had his own preferred way of integrating information. Added to this, individuals tended to be self-consistent in performance. Hence, each individual appeared to retain a preferred way of integrating information over time.

On the other hand, individuals could be separated into two groups based on their performances in the tests. There were poorly-performing individuals who had a tendency to see the field as a single unit. Witkin named this tendency 'field dependence'. On the other hand, individuals who performed well had a tendency to see the objects in their field of vision as separate units. He named this tendency 'field independence'. Witkin asserted that as the individual tends to be self-consistent in performance, field dependence and field independence among individuals will stay constant over time and may appear under various conditions.

The experiments concerned with field dependence and field independence have been replicated by many researchers using different approaches. Based on a review of studies, Witkin indicated certain social characteristics of field-dependent and field-independent persons.

> Field-dependent persons showed a significant increase in a cluster of nonverbal behaviors, such as the palms-up gesture, mouth touching, forward leaning (Witkin, Moore, Goodenough &

Cox, 1977, p. 12).

These behaviors were interpreted as an "expressive of need for closeness to others" (Witkin, Moore, Goodenough & Cox, 1977, p. 12). In contrast, field-independent persons "showed significantly more nonverbal behaviors, such as arm crossing, leg crossing, absence of forward leaning" (Witkin, Moore, Goodenough & Cox, 1977, p. 12). Witkin stated that differences concerning social distance preference exhibited "the boundaries between self and the world outside, particularly other people" (Witkin, Moore, Goodenough & Cox, 1977, p. 3). In other words, field-dependent people are more likely to rely primarily on external references. Field-independent people, by contrast, are likely to rely on internal references. Thus, it appears from the research that there are two extreme tendencies in the processing of information.

If the term 'cognitive style' can define "how individuals conceptally organize the environment" (Goldstein & Blacksmith, 1977, p. 462), field dependence and field independence possibly represent one facet of cognitive style. Thus, field-dependent and field-independent cognitive styles may be conceptually more universal than the original definition.

3.3 Ambiguity of Field-Dependent and Field-Independent Cognitive Styles

An examination of the dichotomous concepts of field-dependent and field-independent cognitive styles requires a consideration of human developmental factors and social factors.

Developmental psychologists such as Jean Piaget claimed that there was a universal sequence in human development. Piaget postulated four stages of human intellectual development identified through his experi-

ments. At the fourth stage, 'formal operations', the person becomes capable of thinking abstractly beyond immediate sensory experience (Swenson, 1980, p. 462). The definition of this period is, more or less, similar to the concept of field-independent cognitive style. Therefore, field-dependent cognitive style may be associated with an earlier stage of development and ascend toward field-independent cognitive style.

Concerning this matter, Witkin organized an experiment to examine the stability of cognitive style using two groups: one group from 8 to 13 years old and another group from 10 to 24 years old. Up to age 17, he found a great increase in the extent of field independence, with no further change from 17 to 24 years old. Within this general tendency, subjects showed relative stability in the extent of field dependence (Witkin, Goodenough & Karp, 1967).

It is held generally that every society teaches behaviors, attitudes and values that are understood and acceptable in that society. These messages are conveyed through child rearing, education, role learning and rites of passage (Plog & Bates, 1980). Within multicultural societies, factors of socialization vary greatly and human cognition is formed in more complicated ways than those of mono-cultural societies. Furthermore, members of every society classify their positions in society according to age, sex, family background, wealth, occupation, educational background and so on. Because of the great variety of social factors that influence personality formation, it is not easy to identify factors which affect field-dependent and field-independent cognitive styles.

3.4 Summary

After discussing the research concerning field-dependent and field-

independent cognitive styles, it is possible to generalize knowledge about these concepts into three points.

(1) *Field-dependent and field-independent cognitive styles may be general concepts that can apply to various conditions.* A field-dependent cognitive style refers to a way of organizing and processing information in which the field is seen as a single unit. This definition includes a tendency to rely mainly upon external references. Field-independent cognitive style refers to a way of organizing and processing information in which the objects in one's field of vision are seen as separate units. This definition includes a tendency to rely upon internal references.

(2) *The relationship between the intelligence of subjects and their cognitive styles cannot be clearly indicated on the basis of the four tests.* In contrast to the results of the three orientation tests which indicated no relation between the results of the tests and intelligence, a relatively high correlation was found between the embedded figures test and the intelligence test. Hence, the intellectual capacity of subjects might influence results of the embedded figures test.

(3) *The concepts of field-dependent and field-independent cognitive styles is only one way of conceptualizing human cognition.* Since many factors are involved in the formation of cognitive styles, it is difficult to identify cognitive style by using only one set of dichotomous concepts, field dependence and field independence. Therefore, it may be necessary to consider other aspects of cognitive styles in order to illustrate a total image of human cognition.

4 Kolb's Learning Styles Inventory

The dichotomous concepts of field-dependent and field-independent

cognitive styles as identified by Witkin classified human cognition into two categories. Hence, an increase in the number of research dimensions regarding human cognition may be required in order to improve an assessment of cognitive styles. One researcher who added to the growing body of information regarding cognitive styles was Kolb.

4.1 Experimental Learning Model

The concept of learning style differs slightly from that of cognitive style, which may be defined as "one's preferred way of receiving information or of gaining meaning from one's environment" (Cranstone & McCort, 1985, p. 136). Although the concept of learning style has a similar meaning to that of cognitve style, learning style focuses on an individual's attitudes towards learning situations, materials, teachers and group activities. Because learning style describes actual learning situations, the measurment criteria more clearly specify conditions of learning than do those of cognitive style.

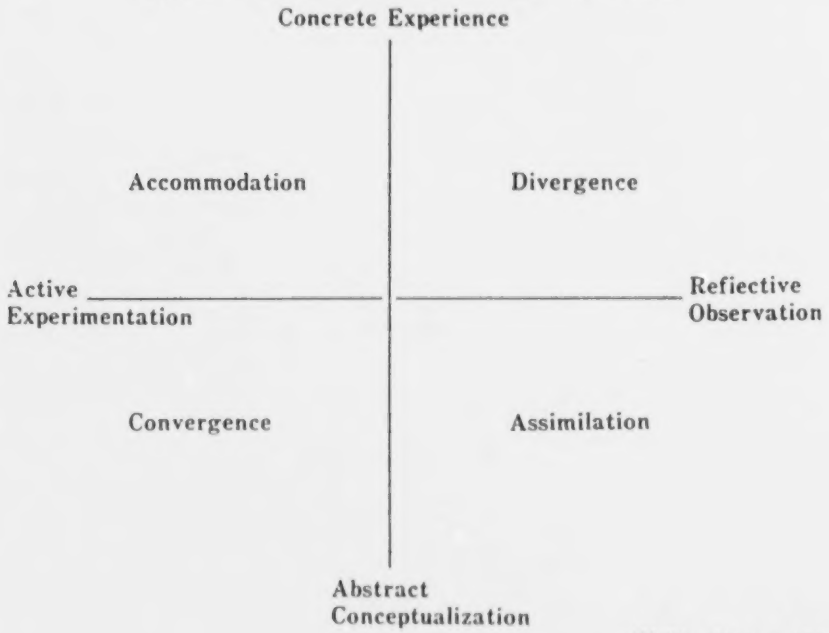
According to Kolb (1971, 1974), learning theoretically is undertaken on the basis of a four-stage cycle, the so-called experimental learning model. At first, a learner will openly and fully experience a new situation without bias (i. e., Concrete Experience). Successively, he will be able to reflect upon and observe his experiences from various perspectives (i. e., Reflective Observation). Furthermore, he will create abstract concepts that may explain and generalize what he has observed (i. e., Abstract Conceptualization). Finally, the learner will use these abstract concepts and generalizations to make decisions and to solve problems (i. e., Active Experimentation). This process repeats by returning to the first stage. Kolb, consequently, assumed that the learner needs four different abilities correspond-

ing to each stage of the experimental learning model.

4.2 Development of Learning Styles Categorization

In Kolb's experimental learning model, there are four stages which require four different abilities. Kolb questioned whether the learner developed all of these abilities, and acted as the model describes. In most cases, the learners continually chose a set of learning abilities which were used in specific learning situations (Kolb, 1974, p. 28). Hence, Kolb considered that an individual may develop his or her own preferred learning style rather than developing all-round abilities required to circulate the learning process. To describe learning styles of individuals, Kolb (1971, 1974) set up two primary dimensions of the learning process based on the experimental

Figure 1 *Learning Styles and the Learning Process*



(Kolb, 1974, p. 35)

learning model shown in Figure 1. The first dimension is drawn from Concrete Experience at one end of the axis and Abstract Conceptualization at the other end. This dimension describes two opposite types of learning processes ; concreteness, which implies learning by immediate experience, and abstraction which implies learning by the formation of concepts. The second dimension is drawn from Active Experimentation at one end of the axis and Reflective Observation at the other end. Active Experimentation in the learning process refers to testing the implications of hypotheses, while Reflective Observation refers to the interpretation of experiences.

By crossing the two dimensional axes, four categories are formed. These categories of learning style are named Convergence, Divergence, Assimilation and Accommodation. Each learning style has two dominant learning abilities : Abstract Conceptualization and Active Experimentation for Convergence ; Concrete Experience and Reflective Observation for Divergence ; Abstract Conceptualization and Reflective Observation for Assimilation ; and Concrete Experience and Active Experimentation for Accomodation. Using these four categories, Kolb developed the Learning Styles Inventory which contained nine items, each consisting of four words. The subject was required to rank the words in order to characterize his learning style (Kolb, 1974). As such, Kolb's Learning Styles Inventory was devised theoretically according to the experimental learning model.

4.3 The Use of Kolb's Learning Styles Inventory in Research

Kolb's Learning Styles Inventory has been used by various researchers. Research findings are generally reported in terms of overall assessment of learning style, change of learning style, relationships between learning style and career choices, and relationship between learning style and per-

sonality factors. Applicability of the assessment to actual classroom learning will be examined through these research findings.

Assessing learning style, Kolb (1971) analyzed the data of his study on the basis of the students' subject majors. Students majoring in the social sciences such as education/liberal arts, history and philosphy, were located in the category of Divergence while those in sciences such as engineering and physics were located in the category of Convergence. In addition, another study (Carrier, Newell & Lange, 1982) indicated that most dental hygiene students were located in the categories of Accommodation and Divergence. Laschinger and Boss (1984) also conducted studies using incoming nursing students and more advanced nursing students. The results showed that a majority of students were located in the category of Accommodation or Divergence.

Concerning changes in learning style, Cahill and Madigan (1984) conducted research using students in an occupational therapy class. During the first week of classes, a pretest was administered. A posttest was administered at the end of four quarters of academic course work. The study found no significant difference between the pretest and the posttest scores on Kolb's Learning Styles Inventory and the Rezler-French Learning Preference Inventory (a type of assessment similar to Kolb's inventory). Between the pretest and the posttest, students devoted their time in the following ways: 10 percent followed the traditional lecture format; 20 percent used small group, laboratory and tutorial format; and 70 percent used a guided independent study format. According to this study, Cahill and Madigan concluded that "students who were involved in different modes of learning over a one-year time period exhibited no significant change" (p. 686).

Wunderlich and Gjerde (1978) reported that there was no association between learning style assessed by Kolb' Learning Style Inventory, and career choices in the field of medicine. In addition, using the same instrument, Laschinger and Boss (1984) conducted a study on the learning style of nursing students and their career choices. In their study, no relationship was found between learning style and preferred nursing specialty.

Furthermore, another study examined the relationship between learning styles described by Kolb and seven personality factors (West, 1982). The result indicated that students in the category of the Convergence learning style had significantly higher scores on the personality factor of social acceptability dimension while no other significant differences were found. On the basis of Kolb's model, however, those in Convergence were expected to score higher on the theoretical, internal control and independence personality factors; hence, the research finding by West was contradicted by these personality characteristics. West concluded that the categories of learning style may not accurately represent the personality types described by Kolb and, hence, may not be effective inscribing the individual's preferred learning style within the medical education context.

4.4 Summary

After reviewing how Kolb developed the categories of learning style and the results of research which used Kolb's inventory, it is possible to generalize four points.

(1) *Kolb theoretically developed the Learning Styles Inventory according to an experimental learning model.* Kolb formed a four-stage model of the learning process. Linking the four points of the stages in the cycle, two dimensions were drawn. These dimensions and the four-stage cycle creat-

ed four categories which indicated four different learning styles (see Figure 1).

(2) *Kolb's Learning Styles Inventory may indicate student's learning style on the basis of the students' subject majors.* Some studies showed differences of learning style among students on the basis of the students' subject majors. This finding implies that students within the same area of subject major tend to share the same type of learning style.

(3) *Learning styles assessed by Kolb's Learning Styles Inventory may be relatively stable over a fairly long time.* Cahill and Madigan (1984) found that students' learning style showed no significant change over a period of one year. During this period, students had experienced different modes of learning; therefore, this finding may indicate that students' learning style will not change by experiencing different learning situations over one year of time.

(4) *Kolb's Learning Styles Inventory will provide only the overall learning style of individuals.* Since there is no known relationship between students' learning style and career choices among medical and nursing students (Wunderlich & Gjerde, 1978; Laschinger & Boss, 1984), Kolb's Learning Styles Inventory may not be useful for assessment beyond the general learning style shared by medical and nursing students. It tends to show overall preferences regarding learning style. Hence, Kolb's Learning Styles Inventory may not provide adequate information for the development of specific education programs and teaching methods congruent with students' learning style.

5 Canfield's Learning Styles Inventory

One of the limitations which has been discussed is that Kolb's Learning

Styles Inventory can assess only overall learning styles of individuals. More specific data on learning styles is required to provide detailed assess ment. Canfield (Canfield & Canfield, 1976 ; Canfield 1980) designed multi-dimensional inventories to assess both learning and instructional styles.

5.1 Multi-Dimensional Assessment of Learning Styles

Dunn (1983) analysed basic elements of learning style. She explained that learning style is comprised of a combination of environmental, emotional, sociological, physical and psychological elements. Furthermore, in a study of more than 20,000 subjects, it was found that there were no fewer than six elements strongly affecting one's learning style and that generally, most people possess between six and 14 elements of learning style.

An assessment called Canfield's Learning Styles Inventory was contrived to assess learning style from various perspectives. Blagg (1985) compared cognitive style and learning style as predictors of academic success. Three different assessments were used : the Hidden Figures Test for cognitive style, the Canfield Learning Styles Inventory for learning style, and the Master's Comprehensive Examination for academic success. The results showed that there was no correlation between academic success and cognitive style as measured by the above instruments. By contrast, "over 20 percent of the variance in scores on the multiple-choice section of the Master's Comprehensive Examination was explained by four learning style variables : Listening, Organization, Independence and Direct Experience" (Blagg, 1985, p. 94). Because this resulf. Blagg concluded that it may be possible to predict the academic success of students from describing the learning style variables of listening and organization. Although the

total number of subjects in Blagg's study (N = 51) was not large enough to draw definitive conclusions, the study provided some evidence that a multi -dimensional assessment of learning style can be used as a predictor of students' academic success.

5.2 Development of Learning and Instructional Styles Assessments

Blagg's study showed that Canfield's Learning Styles Inventory can be used as a predictor of academic success. To correspond to his measure of learning style, Canfield devised the instrument to assess instructional style. By using these two instruments, it became possible to directly compare students' learning styles with teachers' instructional style.

Raines (1977) conducted a study of the learning style of mathematics students and the instructional style of teachers. The research indicated that students with high academic achievement showed closer correlation of learning style to teachers' instructional style. Using the students and faculty members of the academic area of physical therapy in the United States, Payton, McDonald and Hirt (1980) found "an unexpectedly high level of agreement between students and faculty members in preferred modes for teaching and learning" (p. 1281). Within this general trend of similarity, large discrepancies were found in the authority, competition, numeric and reading scales.

5.3 Cultural Factors and Learning Style

The results of studies using both Canfield's Learning Styles Inventory and Instructional Styles Inventory showed that there were significant differences between males and females in community college students in the United States (Canfield & Canfied, 1976 ; Canfield, 1980). Accordingly

Canfield developed learning style norms for males and females. In addition, comparing those above 25 years of age and those below 25 years, significant differences were found. However, no studies have been conducted on cross-cultural situations in learning style using the Canfield inventories.

In a cross-cultural study by Steward (1971), seven ethnic groups were examined to identify the process of how parents teach their preschool-age children. This study used a direct observational method and concluded that there are "stable constellations of behavior within ethnic groups" (Steward, 1971, p. 21). As to interpreting the results of this study, the term 'group personality pattern' used by Benedict (1959) would seem to be appropriate in referring to cultural differences in learning patterns. Benedict describes 'group personality pattern' as meaning that members of a culture have great similarities in ways of thinking and behaving.

Koenig (1981) conducted a cross-cultural study of the 'cognitive styles' of Native and non-Native peoples in Northern Canada and Alaska. She reached the following conclusions:

> ···the non-native sample was the most analytical in thinking style. A portion of the Inuit group was almost as strongly analytical as the non-natives. The Indian group while not strongly analytical was definitely not identified with any other style. In contrast, the Metis group showed no tendency towards being analytical but rather tended towards the relational style (pp. 176-177).

The findings indicate to a modest degree that each cultural group tends to have a dominant cognitive style.

In addition to Koenig's study, Bland (1975) reported that "a basic difference in cognitive strengths and abilities does exist between Navajo,

Hopi, and Jicarilla school children and Caucasian school children" (p. 91). Koenig's concept of 'cognitive styles' and Bland's concept of 'cognitive strengths and abilities' statistically support Benedict's more general notion of 'group personality pattern'.

Further detailed studies of Native peoples have been undertaken using the Illinois Test of Psycholingustic Abilities. In a review of such studies discussed, Kaulback (1984) concluded that :

> ···both Indian and Inuit children are most successful at processing visual information and have the most difficulty performing well on tasks saturated with verbal content (Kaulback, p. 30).

Since non-Native children tend to show better performance on non-verbal tasks, it can be inferred that Native children may gather information in a manner different from that of non-Native children. In classroom situations, these results may reflect a difference in the preferred learning style of Native students. However, it should be noted that the Illinois Test of Psycholingustic is basically designed to measure students' performances in English. Since Native children have grown up with a different cultural and lingustic environment, it is not appropriate to draw a conclusion based only on this type of test.

5.4 Summary

After discussing the multi-dimensional assessment of learning and instructional styles, it is possible to generalize three points.

(1) *The multi-dimensional assessment of learning style provides some information as a predictor of students' academic success.* The great relationship between students' learning style and academic success as indicated by Canfield's inventory suggests that administration of Canfield's Learning

Styles Inventory may provide some information about the predicted academic success of students.

(2) *By using Canfield's Learning Styles Inventory, it may be possible to compare students' learning style with teachers' instructional style.* Canfield designed the assessment of instructional style to correspond to his Learning Styles Inventory. Each of the assessments contain sixteen scales of learning and instructional styles. These scales will assist in providing relatively detailed information concerning the level of congruence between learning and instructional styles.

(3) *Cultural differences should be considered as an influential factor of learning and instructional styles.* Although learning and instructional styles have been found to differ on the basis of sex and age, cultural differences have not been clearly indicated. Therefore, Canfield's Learning Styles Inventory and Instructional Styles Inventory should be used to examine learning and instructional styles on the basis of cultural differences.

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